

What is claimed is:

- 1 1. A control station for two-way satellite communication,
2 comprising:
3 an RF section for transmitting a broadcast signal and receiving a
4 return channel from a remoter user; and
5 a return channel subsystem including a return channel controller
6 to process return channel information and set a user bandwidth in the
7 return channel.
- 1 2. The control station of claim 1, wherein the return channel
2 subsystem further includes a burst channel demodulator to demodulate
3 the return channel information.
- 1 3. The control station of claim 2, wherein the return channel
2 controller controls the burst channel demodulator.
- 1 4. The control station of claim 2, wherein the return channel
2 controller dedicates the burst channel demodulator to the remote user
3 based on a bandwidth allocation request provided by the return channel
4 information.
- 1 5. The control station of claim 1, wherein the return channel
2 controller sets the user bandwidth of the return channel by evaluating a
3 user backlog indicator provided by the remote user in a return channel
4 message.
- 1 6. The control station of claim 5, wherein the return channel
2 message is an ALOHA burst message.
- 1 7. The control station of claim 6, wherein the ALOHA burst
2 message contains a bandwidth allocation request.

1 8. The control station of claim 7, wherein the return channel
2 controller assigns the remote user periodic bandwidth in response to the
3 bandwidth allocation request.

1 9. The control station of claim 6, wherein the ALOHA burst
2 message contains an information packet of a predetermined slot size.

1 10. The control station of claim 5, wherein the return channel
2 controller allocates bandwidth if the user backlog indicator is greater than
3 a threshold value.

1 11. The control station of claim 1, wherein the return channel
2 controller further assigns a frequency of the return channel.

1 12. The control station of claim 11, wherein the return channel
2 controller assigns the frequency of the return channel through an inroute
3 assignment packet provided to the remote user through the broadcast
4 signal.

1 13. The control station of claim 11, wherein the return channel
2 controller changes the frequency of the return channel from a first
3 frequency to a second frequency, said first and second frequencies being
4 within a first return channel group and a second return channel group,
5 respectively.

1 14. The control station of claim 1, wherein the return channel
2 controller changes a frequency of the return channel.

1 15. The control station of claim 14, wherein the return channel
2 controller changes the frequency of the return channel from a first
3 frequency to a second frequency, said first and second frequencies each
4 being within a same return channel group.

1 16. The control station of claim 1, wherein the broadcast signal is
2 an asynchronous DVB transport stream.

1 17. The control station of claim 1, wherein the return channel
2 information is provided by a TDMA signal.

1 18. The control station of claim 1, wherein the return channel
2 controller allocates a stream access return channel to the remote user
3 based on a bandwidth allocation request provided by the return channel
4 information.

1 19. The control station of claim 18, wherein the return channel
2 controller allocates a dedicated frequency to the remote user.

1 20. The control station of claim 18, wherein the return channel
2 controller changes an assigned frequency of the remote user.

1 21. The control station of claim 1, wherein the return channel
2 controller sets the user bandwidth of the return channel by providing a
3 bandwidth allocation packet to the remote user through the broadcast
4 signal.

1 22. The control station of claim 1, wherein the return channel
2 controller assigns the frequency of the return channel by evaluating a

3 user backlog indicator provided by the remote user in a return channel
4 message.

1 23. The control station of claim 1, wherein the RF section receives
2 a plurality of return channels from a plurality of remote users, and
3 wherein said return channel subsystem processes return channel
4 information from the plurality of return channels and sets respective user
5 bandwidths in each of the plurality of return channels.

1 24. The control station of claim 23, wherein a subset of the
2 plurality of return channels are configured to support ALOHA burst
3 transmissions.

1 25. The control station of claim 23, wherein the return channel
2 subsystem further includes a plurality of burst channel demodulators
3 each assigned to an associated one of the plurality of return channels to
4 demodulate respective return channel information.

1 26. The control station of claim 23, wherein the return channel
2 controller assigns bandwidth to each of the plurality of return channels
3 based upon a predicted traffic load.

1 27. The control station of claim 23, wherein the return channel
2 controller assigns bandwidth to a portion of the plurality of return
3 channels based upon a predicted traffic loading, and assigns bandwidth
4 for at least one of the plurality of return channels based upon a
5 bandwidth allocation request.

1 28. The control station of claim 23, wherein the return channel
2 controller provides a load status of a plurality of return channel groups

3 and a load status of the plurality of return channels through an inroute
4 group definition packet provided to the remote user through the broadcast
5 signal.

1 29. A transceiver for transmitting a frame synchronized message
2 to a control node, comprising:
3 a receiver which detects a control node timing message in a received
4 broadcast signal;
5 a timing recovery section which uses the control node timing
6 message to determine a transmit frame start time;
7 a message buffer to store an outgoing user message; and
8 a transmitter adapted to uplink the outgoing user message on a
9 transmit frequency during an assigned period after the transmit frame
10 start time, said transmit frequency being determined by a first inroute
11 group definition packet received in the broadcast signal, wherein said first
12 inroute group definition packet is associated with a first return channel
13 group.

1 30. The transceiver of claim 29, further comprising a processor
2 which provides a traffic backlog indicator included in the outgoing user
3 message.

1 31. The transceiver of claim 29, wherein the transmit frequency is
2 in the first return channel group.

1 32. The transceiver of claim 31, wherein the transmit frequency is
2 changed to a different transmit frequency in the first return channel
3 group based on the first inroute group definition packet received in the
4 broadcast signal.

1 33. The transceiver of claim 31, wherein the receiver receives a
2 second inroute group definition packet in the broadcast signal and the
3 transmit frequency is changed to a different transmit frequency in a
4 second return channel group based on the second inroute group
5 definition packet.

1 34. The transceiver of claim 33, wherein the receiver monitors
2 both the first and second inroute group definition packets in the
3 broadcast signal after uplink bandwidth has been allocated by the control
4 node.

1 35. The transceiver of claim 33, wherein the transmit frequency is
2 changed a predetermined number of frames after the receiver receives the
3 second inroute group definition packet.

1 36. The transceiver of claim 31, wherein the transmit frequency is
2 changed to a different transmit frequency in a second return channel
3 group using a random weighting based on a return channel group load
4 factor.

1 37. The transceiver of claim 29, wherein the assigned period
2 includes at least one TDMA slot after the transmit frame start time.

1 38. The transceiver of claim 37, wherein the assigned period is
2 determined by a bandwidth allocation packet received in the broadcast
3 signal.

1 39. The transceiver of claim 37, wherein the bandwidth allocation
2 packet allocates a stream bandwidth wherein an entirety of TDMA slots in
3 a message frame are dedicated to the outgoing user message.

1 40. The transceiver of claim 29, wherein the assigned period is
2 determined by a predicted traffic load established by the control node.

1 41. The transceiver of claim 29, wherein the received broadcast
2 signal is an asynchronous DVB transport stream.

1 42. The transceiver of claim 29, wherein the receiver monitors a
2 plurality of inroute group definition packets each corresponding to a
3 specific one of a plurality of return channel groups.

1 43. The transceiver of claim 42, wherein the transmit frequency is
2 assigned to be in the first return channel group based on a group load
3 factor received in the broadcast signal.

1 44. The transceiver of claim 42, wherein the transmit frequency is
2 changed to be in a different return channel group based on a group load
3 factor received in the broadcast signal.

1 45. The transceiver of claim 42, wherein the transmit frequency is
2 changed to a different group of the plurality of return channel groups
3 based on a random weighting factor provided in the broadcast signal.

1 46. The transceiver of claim 29, wherein the outgoing user
2 message is encrypted.

1 47. The transceiver of claim 29, wherein the outgoing user
2 message is compressed in accordance with a lossless compression
3 standard.

1 48. The transceiver of claim 29, wherein the outgoing user
2 message is transmitted on a lossless return channel.

1 49. The transceiver of claim 29, wherein the outgoing user
2 message is modulated on the transmit frequency using a QPSK
3 modulation scheme.

1 50. The transceiver of claim 49, wherein the QPSK modulation
2 scheme is an Offset-QPSK (OQPSK) scheme.

1 51. The transceiver of claim 29, wherein the outgoing user
2 message is limited to a maximum bandwidth by the control node.

1 52. The transceiver of claim 29, wherein the outgoing user
2 message is in an ALOHA burst format.

1 53. The transceiver of claim 52, wherein the ALOHA burst
2 transmits the outgoing user message at least twice.

1 54. The transceiver of claim 52, wherein the ALOHA burst is
2 retransmitted a maximum number of times indicated by a message
3 received in the broadcast signal.

1 55. The transceiver of claim 52, wherein the outgoing user
2 message contains a bandwidth allocation request.

1 56. The transceiver of claim 52, wherein the ALOHA burst is a
2 slotted-ALOHA burst aligned with the transmit frame start time.

1 57. The transceiver of claim 52, wherein the outgoing user
2 message has a size less than a predetermined threshold value.

1 58. A method for controlling a return channel from a control
2 station, comprising:
3 transmitting a broadcast signal;
4 receiving a return channel uplink from a remote user; and
5 setting a return channel bandwidth with a return channel controller
6 which provides a bandwidth allocation message in the broadcast signal.

1 59. The method of claim 58, further comprising demodulating the
2 received return channel uplink with a burst channel demodulator
3 controlled by the return channel controller.

1 60. The method of claim 58, wherein the return channel
2 bandwidth is set by evaluating a backlog indicator provided by the remote
3 user in a return channel message.

1 61. The method of claim 60, wherein the return channel
2 controller allocates bandwidth if the backlog indicator is greater than a
3 threshold value.

1 62. The method of claim 60, wherein the return channel uplink is
2 an ALOHA-type burst message.

1 63. The method of claim 62, wherein the ALOHA-type burst
2 message is a slotted-ALOHA message.

1 64. The method of claim 58, wherein the broadcast signal is an
2 asynchronous DVB transport stream.

1 65. The method of claim 58, wherein the return channel uplink is
2 a TDMA signal.

1 66. The method of claim 58, wherein the return channel
2 controller controls a frequency of the return channel uplink through an
3 assignment message provided to the remote user through the broadcast
4 signal.

1 67. The method of claim 66, wherein the return channel
2 controller changes the frequency of the return channel uplink from a first
3 frequency to a second frequency, said first and second frequencies each
4 being within a first return channel group.

1 68. The method of claim 66, wherein the return channel
2 controller changes the frequency of the return channel uplink from a first
3 frequency to a second frequency, said first and second frequencies being
4 within a first return channel group and a second return channel group,
5 respectively.

1 69. The method of claim 58, wherein the return channel
2 bandwidth is set in accordance with a bandwidth allocation request
3 received in the return channel uplink.

1 70. The method of claim 69, wherein the return channel
2 controller assigns periodic bandwidth to the remote user.

1 71. The method of claim 70, wherein the return channel
2 controller assigns a stream bandwidth to the remote user.

1 72. The method of claim 71, wherein the return channel
2 controller assigns a dedicated return channel uplink frequency to the
3 remote user.

1 73. The method of claim 58, further comprising:
2 receiving a plurality of return channel uplinks from a plurality of
3 remote users; and
4 setting a return channel bandwidth for each of the plurality of
5 return channel uplinks with the return channel controller.

1 74. The method of claim 73, wherein the return channel
2 controller controls a frequency of each of the plurality of return channel
3 uplinks through an assignment message.

1 75. The method of claim 73, wherein setting a return channel
2 bandwidth for each of the plurality of return channel uplinks includes
3 predicting a return channel traffic load.

1 76. The method of claim 73, wherein a return channel bandwidth
2 for a portion of the plurality of return channel uplinks is set using a
3 predicted return channel traffic load, and a return channel bandwidth for
4 at least one of the plurality of return channel uplinks is set based upon a
5 bandwidth allocation request transmitted on said at least one of the
6 plurality of return channel uplinks.

1 77. The method of claim 73, wherein setting a return channel
2 frequency for each of the plurality of return channel uplinks is based on
3 evaluating a traffic load for each of the plurality of return channel
4 uplinks.

1 78. The method of claim 73, wherein a group load factor for each
2 of a plurality of return channel groups is periodically transmitted in the
3 broadcast signal.

1 79. The method of claim 78, wherein a frequency for each of the
2 plurality of return channel uplinks is determined by a corresponding
3 group load factor.

1 80. The method of claim 78, wherein a bandwidth for each of the
2 plurality of return channel uplinks is determined by a corresponding
3 group load factor.

1 81. The method of claim 73, wherein setting a return channel
2 group for each of the plurality of return channel uplinks is based on
3 evaluating a traffic load for each of a plurality of return channel groups.

1 82. A method for transmitting a frame synchronized message,
2 comprising:
3 receiving a control node timing message in a broadcast signal;
4 determining a return channel frame start time using the control
5 node timing message;
6 storing an outgoing user message; and
7 transmitting the outgoing user message during an assigned period
8 after the return channel frame start time, wherein a transmit frequency is
9 determined by an assignment message received in the broadcast signal.

1 83. The method of claim 82, further comprising evaluating the
2 stored outgoing user message and transmitting a traffic backlog indicator.

1 84. The method of claim 82, wherein said assignment message is
2 associated with a first return channel group, and said transmit frequency
3 is in said first return channel group.

1 85. The method of claim 84, wherein the transmit frequency is
2 changed to a different transmit frequency in the first return channel
3 group based on said assignment message.

1 86. The method of claim 84, wherein the transmit frequency is
2 changed to a different transmit frequency based on a traffic load factor.

1 87. The method of claim 82, wherein the transmit frequency is
2 changed from a first return channel group to a different transmit
3 frequency in a second return channel group.

1 88. The method of claim 82, further comprising changing the
2 transmit frequency to a different transmit frequency based on a random
3 weighted frequency selection based on a traffic load factor.

1 89. The method of claim 82, further comprising monitoring a
2 previous return channel group and a current return channel group after
3 the transmit frequency has been assigned to the current return channel
4 group.

1 90. The method of claim 82, wherein the transmit frequency is
2 changed to a different transmit frequency a predetermined number of
3 frames after receiving the assignment message.

1 91. The method of claim 82, wherein the assigned period is
2 determined by a bandwidth allocation message received in the broadcast
3 signal.

1 92. The method of claim 82, wherein transmitting the outgoing
2 user message includes transmitting an ALOHA burst message.

1 93. The method of claim 92, wherein the ALOHA burst transmits
2 the outgoing user message at least twice.

1 94. The method of claim 93, wherein the ALOHA burst is
2 transmitted a maximum number of times as indicated by a message
3 transmitted in the broadcast signal.

1 95. The method of claim 92, wherein the ALOHA burst message
2 includes a bandwidth allocation request.

1 96. The method of claim 82, further comprising encrypting the
2 outgoing user message.

1 97. The method of claim 82, wherein the outgoing user message
2 is transmitted in a TDMA format.

1 98. The method of claim 97, wherein transmitting the outgoing
2 user message includes transmitting a slotted ALOHA burst message
3 aligned with the return channel frame start time.

1 99. The method of claim 97, wherein the assigned period includes
2 at least one time slot after the return channel frame start time as

3 determined by a bandwidth allocation message received in the broadcast
4 signal.

1 100. The method of claim 82, further comprising compressing the
2 outgoing user message using a lossless compression standard.

1 101. The method of claim 82, wherein transmitting the outgoing
2 user message includes modulating the transmit frequency using a QPSK
3 modulation scheme.

1 102. The method of claim 82, further comprising limiting the
2 outgoing user message to a maximum bandwidth less than a stream
3 bandwidth.

1 103. A communication system for balancing traffic on a plurality of
2 return channels, comprising:
3 a control station to transmit a broadcast signal to a remote user,
4 said broadcast signal including a non-real time frame marker, a
5 timing message, and a return channel control message;
6 a receiver at the remote user to receive the broadcast signal and
7 determine a return channel frame start time using the non-real time
8 frame marker and the timing message; and
9 a transmitter at the remote user to uplink a user message on one
10 return channel of the plurality of return channels during a predetermined
11 period after the return channel frame start time, wherein an uplink
12 frequency of said one return channel is determined by the return channel
13 control message.

1 104. The communication system of claim 103, wherein a
2 bandwidth of said one return channel is determined by the return
3 channel control message.

1 105. The communication system of claim 103, further comprising
2 a return channel controller in the control station, said return channel
3 controller providing the return channel control message.

1 106. The communication system of claim 105, wherein the return
2 channel controller further provides a bandwidth allocation message in the
3 broadcast signal which sets a bandwidth of said one return channel.

1 107. The communication system of claim 106, wherein the
2 bandwidth of said one return channel is set based on a predicted load
3 factor.

1 108. The communication system of claim 105, wherein the
2 bandwidth of said one return channel is set by evaluating a user backlog
3 indicator transmitted by the remote user to the control station.

1 109. The communication system of claim 108, wherein the
2 bandwidth of said one return channel is set to a stream bandwidth.

1 110. The communication system of claim 108, wherein the uplink
2 frequency of said one return channel is set to a dedicated frequency based
3 on an evaluation of the user backlog indicator.

1 111. The communication system of claim 105, wherein the return
2 channel controller changes the uplink frequency to a different frequency
3 within a first return channel group.

1 112. The communication system of claim 105, wherein the return
2 channel controller changes the uplink frequency to a different frequency
3 within a second return channel group.

1 113. The communication system of claim 112, wherein the return
2 channel controller changes the uplink frequency to a different frequency
3 based on a system load factor.

1 114. The communication system of claim 103, wherein a
2 bandwidth of said one return channel is determined by a bandwidth
3 allocation request included in the user message uplinked by the remote
4 user.

1 115. The communication system of claim 114, wherein the user
2 message is an ALOHA-type burst transmission.

1 116. The communication system of claim 115, wherein the user
2 message includes the bandwidth allocation request and an additional
3 user message, said additional user message having a size less than a
4 predetermined threshold size.

1 117. The communication system of claim 103, wherein said
2 broadcast signal is an asynchronous DVB transport stream.

1 118. The communication system of claim 103, further comprising
2 a plurality of remote users sharing the plurality of return channels and a
3 return channel controller, wherein the return channel controller controls
4 the uplink frequency of each of the plurality of return channels through
5 the return channel control message.

1 119. The communication system of claim 118, wherein said return
2 channel controller controls a bandwidth allocation for each of the
3 plurality of return channels.

1 120. The communication system of claim 118, wherein a subset of
2 the plurality of return channels are ALOHA burst channels, and wherein
3 said return channel controller shifts a remote user uplink from an ALOHA
4 burst channel to a non-ALOHA burst channel in accordance with the
5 return channel control message.

1 121. The communication system of claim 120, wherein the ALOHA
2 burst channel is selected from the subset of the plurality of return
3 channels by the remote user using a random weighted frequency selection
4 criteria.

1 122. The communication system of claim 120, wherein said non
2 ALOHA burst channel is selected by the control station using a group load
3 factor.

1 123. The communication system of claim 103, wherein said
2 broadcast signal is encapsulated in an IP/DVB protocol layer.

1 124. The communication system of claim 103, further comprising
2 a communication satellite to relay the transmitted broadcast signal to the
3 receiver.

1 125. A method for balancing loads among and between groups of
2 return channels in a communication system, comprising:

3 requesting return channel bandwidth in an uplink message from a
4 remote user to a control station, said uplink message including a backlog
5 indicator;

6 allocating at least a return channel bandwidth for the remote user
7 by processing the backlog indicator;

8 providing a channel allocation message from the control station to
9 the remote user in a broadcast signal, wherein the channel allocation
10 message at least allocates the return channel bandwidth; and

11 transmitting a user message on a return channel in accordance
12 with the channel allocation message.

1 126. The method of claim 125, further comprising allocating a
2 return channel uplink frequency.

1 127. The method of claim 126, wherein allocating the return
2 channel uplink frequency includes changing an uplink frequency from a
3 first frequency to a second frequency.

1 128. The method of claim 127, wherein the uplink frequency is
2 changed to balance a traffic load between the groups of return channels.

1 129. The method of claim 127, wherein the uplink frequency is
2 changed based on a group load factor.

1 130. The method of claim 127, wherein the first frequency and the
2 second frequency are assigned to a first return channel group.

1 131. The method of claim 127, wherein the first frequency and the
2 second frequency are assigned to a first return channel group and a
3 second return channel group, respectively.

1 132. The method of claim 126, wherein allocating the return
2 channel uplink frequency includes frequency hopping an uplink
3 frequency between a predetermined number of uplink frequencies in
4 accordance with a dynamic system traffic load.

1 133. The method of claim 132, wherein allocating the return
2 channel uplink frequency by frequency hopping further depends on a
3 plurality of backlog indicators from a plurality of remote users.

1 134. The method of claim 132, wherein the predetermined number
2 of uplink frequencies are assigned to a return channel group.

1 135. The method of claim 132, wherein frequency hopping
2 balances a traffic load within a first return channel group.

1 136. The method of claim 125, wherein requesting return channel
2 bandwidth includes transmitting an ALOHA burst transmission from the
3 remote user.

1 137. The method of claim 125, wherein the return channel
2 bandwidth is allocated to at least allow a user message smaller than a
3 predetermined threshold size to be uplinked.

1 138. The method of claim 125, wherein a portion of available
2 return channels are ALOHA-burst return channels.

1 139. The method of claim 125, wherein the control station
2 periodically transmits a group load factor for each of the groups of return
3 channels.

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1 140. The method of claim 125, wherein requesting return channel
2 bandwidth includes transmitting a first ALOHA-type burst transmission
3 from the remote user on an ALOHA channel .

1 141. The method of claim 125, further comprising the remote user
2 selecting the return channel from one of the groups of return channels by
3 using a random weighting factor based on a system traffic load.